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RESEARCH REPORT

SPACE TECHNOLOGY AND THE SOVIET/US STRATEGIC COMPETITION: A PERSPECTIVE AND FORECAST USING TWELVE-YEAR CYCLES

COLONEL GEORGE W. CRISS III

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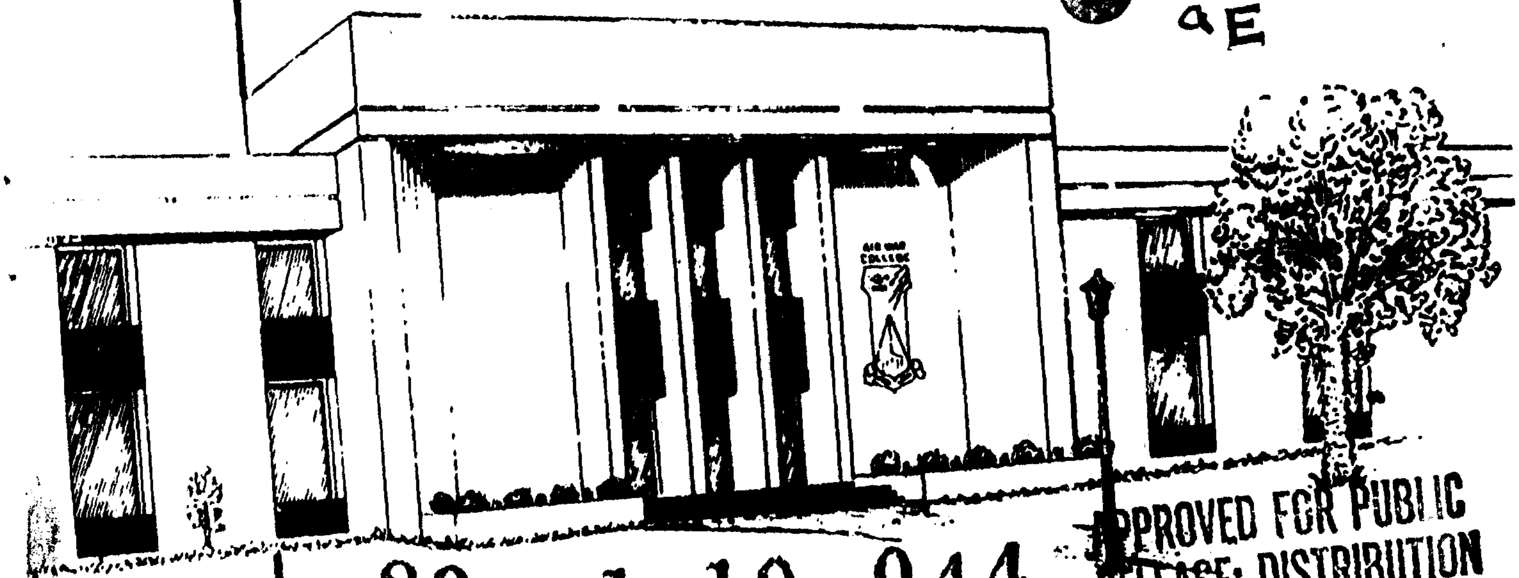

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SPACE TECHNOLOGY AND THE SOVIET/US STRATEGIC COMPETITION: A PERSPECTIVE AND FORECAST USING TWELVE-YEAR CYCLES

by

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A RESEARCH REPORT SUBMITTED TO THE FACULTY

IN

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AIR WAR COLLEGE RESEARCH REPORT ABSTRACT

TITLE: Space Technology and the Soviet/US Strategic Competition: A Perspective and Forecast Using Twelve-Year Cycles

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This report contends that exploiting space technology for national power has been the dominant theme of the US/Soviet strategic competition since World War II. Furthermore, markedly different approaches to realizing this potential have evolved on both sides. To support this thesis, the author develops a paradigm of 12-year cycles marked by major space spectaculars. The all important political and strategic conditions which surround and shape these major events are explored, compared, and linked. A second thesis, that this 40-year competition has led to swift retaliatory nuclear forces far in excess of desirable levels, is then presented and supported. Finally, conclusions distilled from the foregoing historical perspective and the current space-strategic situation, plus a forecast, are offered.

Keywords: V-2, Sputnik, Apollo, Space Shuttle, (KF)

BIOGRAPHICAL SKETCH

Colonel G.W. "Bill" Criss has been fascinated by the interplay between space and national power since he was eleven. At this age, he experienced the impact of Sputnik while living in a third world country. This interest led to a Masters Degree in Astronautics from Rensselaer Polytechnic Institute and to a career in the United States Air Force.

He has served in numerous research, development and acquisition positions involving both space and air systems. These include: NAVSTAR Global Positioning System, the B-1 Bomber, the E-3A AWACS, and the National Aerospace Plane. He spent two tours directing on-orbit operations of several satellite programs. While assigned to the Office, Secretary of the Air Force, Space Systems, he helped develop guidelines and objectives for engaging the Soviets in the on-going Space and ASAT negotiations.

Prior to graduating from the Air War College, class of 1988, he was the Director, Special Activities, at HQ Air Force Systems Command. There, he was responsible for programs that will capitalize on technology breakthroughs well into the next century.

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CHAPTER I

INTRODUCTION

The Strategic Defense Initiative (SDI), born by President Reagan in his now famous "Star Wars" speech, has sparked a public debate of strategic issues on a scale not heard since the "Missile Gap" episode of the late 1950s. While not always public topic number one, however, the connection between space and national security, which underlies the SDI debate, is neither novel nor SDI specific.

This paper offers a set of historical benchmarks to provide the needed political and strategic perspective for discussing space and its future potential. These benchmarks are provided by a curious 12-year cycle that is shown to exist in space-related activities. Starting with 1945, this device is used to discuss the major cause-and-effect relationships surrounding singular events at the beginning of each cycle. Emphasis is palced on the major political and technological trends of each period and on the contrast of these trends within the US and the USSR. From this analysis, the markedly different US and Soviet approaches to space utilization that have evolved over the past four decades can be clearly seen and understood. Armed with the perspective gained by using this 12-year paradigm, the appreciation of space, military space, held by each superpower is then explored. The *de facto* space doctrine of each, thus distilled, serves to highlight the trends and possibilities inherent in the current East-West situation. The crux of this discussion is that the calculus of the strategic relationship has changed. While space now holds the potential for far greater military exploitation, the precipitous growth in the numbers of prompt-delivery nuclear warheads has yielded a situation which challenges the wisdom of deploying additional strategic offensive systems.

Lastly, conclusions are offered to help guide the weighty decisions now being made that will lead to the next node in the 12-year cycle: 1993.

CHAPTER II

1945: THE V-2 TRANSPLANTS

When Soviet and American troops finally met at the Elbe River in April 1945, the end of Nazi ambitions was secured. The war formally ended in Europe two weeks later. Germany lay divided and occupied by the four Allied powers. Territory, however, was not the only asset of the Third Reich to be shared. During the late spring and summer of 1945, the teams of scientists, engineers and technicians responsible for the most revolutionary weapons of the war became prizes of either East or West. Some chose voluntarily, others had less of an option, but ultimately the V-2 rocket team from Peenemunde found new employers for its particular genius. Given the mystique and terror of the V weapons in actual employment, and of rumored advancements, the motivation of each side was understandable. The degree of emphasis eventually placed on these new national acquisitions, however, varied widely.

With the Russian army approaching, Dr. Wernher von Braun led a hasty attempt to secure the most valuable of the Peenemunde research results and then moved his team south, to Oberammergau. On 2 May 1945, initial contacts were made with American forces, eventually leading to the relocation of von Braun and most of his group to White Sands, New Mexico, by early 1946.[1]

Although eager to continue their rocketry research, the team would meet great frustration. The war was over. American defense expenditures dropped by an order of magnitude (see Appendix, figure 1). In spite of the interest, and warnings, of a small circle of professional military and civilian strategists, the V-2 team and their captured rockets were regarded more as technical curiosities than legitimate claimants to almost non-existent defense research dollars.[2] Test firings of the V-2s were common, but investment in the team's more advanced theories did not materialize. During some 64 firings from White Sands (and even one from an aircraft carrier), the only decisive government reaction forthcoming was not over missile and space potential, but over a near miss of Juarez, Mexico, by a wayward V-2.[3] Total budgetary indifference to defense, however, would not last indefinitely.

Prodded from the post-war euphoria by a series of events in Eastern Europe, and later Korea, investment in things military again became politic. This shift, while tripling defense authorizations, was still not of immediate help to the embryonic space effort; higher priorities prevailed. The huge American military forces of 1945, including the decisive strategic bombing elements, were in neglect-induced disrepair. The "nuclear monopoly" fondly remembered in current histories was actually a largely impotent enterprise--incapable of expression. To dramatize this point, bombing exercises were ordered by General C. LeMay shortly after his appointment as Commander in Chief of the Strategic Air Command in late 1948. The performance of the residual war fleet of B-29s was unbelievably dismal.[4] On the other hand, the needed technological and the industrial bases were at hand to resolve this militarily embarrassing state-of-affairs. So, too, were the political and strategic conditions.

The Soviet Union was displaying an aggressiveness that is difficult to comprehend today, even after Afghanistan. In response, the North Atlantic Treaty was formalized in 1949, but it was an alliance without strategy or substance. Its choices rapidly distilled to either: 1) match the Soviet's ground strength, or 2) find a credible way to threaten employment of "the bomb." Economics won the argument and "defense-on-the-cheap" was born.[5] The US would expand the Strategic Air Command and Europe would provide forward bases.

Thus began a stream of bombers, impressive in quantity and diversity, that would dominate American military thinking--and budgets--for some time to come. It would also further expand the country's technology base and eventually encourage the exploration of military alternatives for nuclear delivery.

In 1950, von Braun and his team were moved to the reactivated Redstone Arsenal in Huntsville, Alabama.

Funding was still extremely low, but a mission had been finally assigned (a 500 mile range, V-2 derivative). Also, technical momentum, elsewhere, was building.[6] The Rand Corporation, in November of that year, strongly recommended further research into monitoring earth-bound activities via artificial satellite. While an excellent systems analysis effort, the RAND report was unable to capture sufficient budgetary attention.[7] Three years later, the first Redstone launch was attempted (a failure)--and the Soviet Union detonated its first hydrogen bomb. The Cold War was heating up, yet missile research, at least in the US, was still kept squarely on the back burner. Meanwhile, a different story had unfolded in Soviet-occupied Europe.

As the von Braun team plodded through initial interrogations in the summer of 1945, similar events were occurring in the Soviet occupied sector of Germany. In addition to collecting much of the surviving industry used to produce the V-2, the Soviets were busy assembling a large team of technical personnel found under their control at war's end. While membership on this team was not generally a voluntary affair, there were notable exceptions.

Helmut Grottrup, a member of the Peenemunde inner circle, spent several months negotiating with both the Americans and the Soviets. The American offer to Grottrup included separation of unknown duration from family and country. The Soviets promised neither of these shortcomings, and even included reasonable salaries, homes and other post-war "luxuries." Hence, while the West succeeded in wooing and exporting most of the top German scientists, the Soviets had fallen heir to a formidable amount of engineering and technical expertise.[8] With Grottrup's help, they would exploit this prize without delay.

A half dozen manufacturing and support facilities were repaired rapidly. The first static firing of a V-2 engine was conducted under appreciative eyes on 6 September 1945. Also under Grottrup's leadership, a five thousand man, pilot-production V-2 line was reopened at the Zentralwerke.[9] Engineering drawings for the V-2 were re-accomplished in Russian, and, by mid-1946, studies of improved versions were well underway.[10] All the while, Soviet scientists and technicians rotated through the rejuvenated facilities. The resulting hardware and production techniques of the plant were not the only items of intense study--the German technical management skills were also under scrutiny. The seed from Peenemunde had fallen on fertile soil. Suddenly the genuinely courteous and productive relationship ended, to the vast surprise of Grottrup, et al., on 22 October 1946.

The entire Zentralwerke production line: equipment, parts, assembly lines and Germans, were moved <u>en masse</u> on specially detailed trains to several locations well inside the Soviet Union.[11] The Zentralwerke ensemble was joined by thousands of tons of equipment from Peenemunde and other locations to form the nucleus of an organic development, test, and production capability. Concomitantly, several institutions were formally established by the Soviet leadership to develop ballistic rockets.[12] A launching site was built at Kapustin Yar, and the first rockets launched in just under one year after the transplant from Germany began.[13]

Although less than enthusiastic about the unilaterally revised terms of "employment," Grottrup and the small army of V-2 experts and technicians had little choice, and had to cooperate. They provided the expertise needed to realize the evolving plans of a special task force established by Stalin to end-run the perceived American strategic pre-eminence. In the 1947 words of Georgiy Malenkov, Stalin's heir apparent:

> This V-2 is not what we want. We have improved it, we have more than reached the Peenemunde level of 1945, but, even so, it remains a blind, short-range, primitive weapon . . . .We must work on the development of long-range rockets. And we certainly cannot wait until the American Imperialists add (the long range) rocket plane to their B-29 and atom bomb.[14]

Design work on this "long-range rocket" produced test firings in early 1948. Development was completed by 1949 and a follow-on design test fired the same year.[15] Although crude by today's standards, this vehicle represented a major advance. It doubled the range of the earlier model, used aluminum alloy, and had a separable nose compartment.[16] Several different launch vehicles and many instrumentation modules followed in rapid succession. Attitude control, stabilization, ionospheric and astronomical experiments were conducted up to an altitude of 500 km. By the time Dr von Braun and the Americans were preparing their first Redstone launch attempt, over a dozen Soviet experiments using dogs had dispelled medical uncertainty as to the possibility of manned space flight.[17]

The assimilation and capitalization of the Peenemunde advances by East and West could not be more different. In historical perspective, however, this difference is easily understood. The military potential of the Wrights' airplane was largely ignored by the US until well after World War I, and the inventions of Dr Robert Goddard sparked little government interest in his own country. Goddard's early experiments with the first liquid fueled rockets near Boston, Massachusetts, in 1926, however, provoked keen interest in Germany, and in the Soviet Union.[18]

After the Nazi defeat, and in spite of a virtually nonexistent technological and industrial base, the USSR acted upon a clear vision of the tremendous psychological and military implications of the German rocket advances. Encircled by a hostile world dominated by American industry which was untouched by war, the V-2 derivatives offered

Stalin the only hope of competing at global distances. It was a technical long shot, but one borne of dialectic necessity and compatible with Soviet academic pursuits prior to the war.

For the Americans, once revived from their four-year geopolitical autism following WWII, the answer to the reluctantly shouldered challenge was obvious: air power and the bomb. Air power had, after all, ended the war in the Pacific and thwarted Soviet moves against Berlin in 1948. As for any serious national effort to fund the transplanted potential from Peenemunde, Dr Vannevar Bush, Director of the Office of Scientific Research and Development, set the official tenor in 1946 on the possibility of ocean spanning missiles: "I say technically I don't think anybody in the world knows how to do such a thing, and I feel confident it will not be done for a very long period of time to come."[19] The breakup of the Peenemunde team in 1945 began events of enormous strategic importance which overshadowed another space event of that year. A wide-eyed member of the British Interplanetary Society, Arthur C. Clarke, advanced the incredible notion of using geostationary, artificial, earth satellites for global communications networks.[20] Naturally, few took him seriously.

CHAPTER III

1957: SPUTNIK

Twelve years after the break up of Peenemunde, almost all of the German engineers and technicians conscripted by the Soviets had been allowed to return home. Their counterparts in America, by and large, had grown accustomed to a new culture, citizenship and the new world order unfolding in the events of the cold war. The protracted negotiations which ended the Korean conflict in 1953 and, in 1955, ended the post WWII Soviet occupation of Austria, yielded an uneasy--yet workable--structure to East-West relations.

The West had NATO, and the US its spheres of influence; Russia had its Warsaw Pact and de facto recognition by the West of the status of her reluctant satellites. The durability of this structure was put to the test by events in Hungary during the fall of 1956. In spite of some unwittingly cruel propaganda to the contrary, the US did not aid the nationalistic elements fighting to leave the Soviet orbit.[1] "Defense-on-the-cheap" with its nuclear threat might keep Western Europe secure, but the Red Army would remain uncontestable in its respective sphere of influence.

Intermingled with this geo-political backdrop, the technology of strategic warfare was producing new arsenals on both sides. The American decision to concentrate on the long-range bomber was now in high gear. The Soviets, in keeping with the political bluster of the era, unwittingly aided the air power proponents by repeatedly cycling a small group of long-range bombers past reviewers at an Aviation Day display in 1955.[2] The resulting illusion gave credence to the "bomber gap" and the justification for even more US aircraft. The Soviets, however, had no intention, or ability, of matching the apprehensive US intelligence estimates. Their emphasis remained on the rapidly evolving technologies of the ballistic missile.

Ironically, Premier Malenkov, quoted earlier for his prophetic and energetic support of V-2 derivatives, fell from grace partially over the cost of continuing this emphasis. Embracing a slower military buildup and more consumer goods, he was outflanked on the political right by Nikita Khrushchev and supporters of a more aggressive military posture.[3] By the time Khrushchev had won full control at the 20th Party Congress in 1956, Soviet IRBMs were a reality and his promise of a successful ICBM was nearing fruition.

The year 1957 began, appropriately enough from the American perspective, with an around-the-world record setting bomber flight by a Strategic Air Command B-52. The Command had operational about 1200 B-47 medium bombers, over 200 of the brand new B-52s and a smaller number of the older, slower B-36s.[4] A supersonic delivery vehicle, the B-58, was on the drawing boards. To most, primacy of long-range, nuclear-armed aircraft in American strategic thinking was unquestioned--until 4 October 1957.

Sputnik-1 totally electrified the entire world.[5] To the American public, it was a horrible mixture of shame, anxiety, and disbelief. The size of the thing (nearly 200 pounds) and the TASS announcement, barely a month previous, as to the world's first successful ICBM test, was not at all lost on the American press. Just 30 days later, Sputnik-2 blasted off (at over 1000 pounds) carrying Laika, the space dog. To make matters worse, the first US attempt, Vanguard-1, with only a grapefruit-sized experimental package, ended in a gloryless blaze after reaching an altitude of only a few feet. The just abated bomber gap was pale in comparison. Now there were gaps everywhere: missile gaps, space gaps, engineer gaps, but especially a gap in American pride.

The disbelief of the public, however, could not be shared by the Eisenhower Administration. Intelligence and open source warnings were legion.[6] Two years earlier, the USSR had announced plans for orbiting an artificial satellite as part of her participation in the International Geophysical Year (three days after the US had so announced). The same secret U-2 flights that dispelled the bomber gap fears must have also shown the seriousness of

Soviet rocket research.[7] Numerous official studies commissioned by the government all pointed to the growing technical capabilities of the USSR, and to her space and missile potential, in particular.[8] CIA and Air Force estimates soberly predicted a range from 500 to 1000 operational ICBMs by 1961.[9] Things, however, were not as one-sided as they seemed.

In the United States, the space and missile lethargy of the late 1940s and early 1950s had slowly been replaced by broad-based, although low-keyed, research and feasibility studies. The Rand Corporation, in its "Feed Back" reports of 1954, was especially perceptive. Strategic surveillance, communications, weather, mapping, support facilities, and critical engineering requirements were all presented in detailed and convincing terms.[10] Broad acceptance at lower levels of government of such conclusions eventually led to the approval of several IRBM, ICBM and orbital requirements in 1955.[11] Lack of clear direction at the upper levels of the administration, interservice rivalries, and the resulting underfunding, however, kept progress at a much slower pace than was possible. There were other factors as well.

Eisenhower's earnest desire to somehow restrain military competition with the Soviet Union was pivotal in the events leading up to the Sputnik "surprise." Unnecessary acceleration of the coming space and missile age was not an option that he viewed with favor.[12] Even defense-on-the-cheap carried a financial burden that ran afoul of Ike's conservative fiscal nature. The embarrassingly slow entry of the US into the space race, however, was actually more philosophical than financial. Space exploration as a sanctuary from direct military competition was not just an ideal, it was National Policy. America's space contribution to the IGY was ordered, via NSC directive 5520, to be launched by a booster devoid of any alternative military mission.[13] On the other hand, better knowledge of Soviet military gains was also deemed absolutely essential (the U-2 gambit was always known to be of limited duration).[14] Hence, while Vanguard unsuccessfully played development catch-up to both USSR and US military booster programs, other US space elements, tied more directly to national security requirements, progressed along different lines. According to several authors, planning for a strategic satellite surveillance system was underway by the time Sputnik startled the world.[15] This dual approach to space, civil and strategic, was to survive and prosper in the wake of the Soviet "surprise."

The period immediately following the initial Soviet successes produced enormous institutional and political changes. To force a better focus within the Department of Defense and to help resolve the many inter-service battles emerging over space, the Advanced Research Projects Agency

(ARPA) was formed.[16] With funding no longer a major issue, existing ICBM and SLBM developments were accelerated, and new ones formulated. The Air Force was eventually given the surveillance, mapping, strategic warning and military booster/staging/recovery developments. The Army and Navy would concentrate on missile defense, communications and navigation functions.[17] While these roles and missions were being hammered out between ARPA and the services, the dual civil-military approach to national space objectives was codified by the establishment of the National Aeronautics and Space Administration. Dr von Braun and his Army-sponsored team, after a hurry-up launch via military booster of the first US satellite, would move to the new agency. NASA would be prime on scientific exploration, civil applications, and man-in-space experiments. While the separate emphasis and authority of the two national programs was clear, so too was their inherent symbiotically relationship. Space had come to be perceived, first and foremost, as an arena for expanding and exercising national power. Politicizing this maxim contributed greatly to John Kennedy's winning the White House from Eisenhower's heir apparent, Richard Nixon--just as Khrushchev had outflanked Stalin's choice, Malenkov, by essentially the same technique.

As the US programs struggled, literally, to get off the ground, Khrushchev pressed his enormous Sputnik-gained propaganda advantage. The lesson of the bomber gap deception unlearned, his threats to produce ICBMs like sausages appeared reinforced by each new space spectacular. Behind the bravado, however, were serious industrial and institutional shortcomings. To address these and the overall strategic planning effort, Khrushchev had commissioned a special study team composed of top military and party officials. Within this important team was the Strategic Planning Group, whose chairman was one Leonid Brezhnev. He received Politburo approval of his recommendations concurrent with preparations for the first Soviet ICBM test.[18] The group strongly emphasized the importance of nuclear first strikes in any future global conflict. It was, in effect, policy and strategy affirmation that the technical long-shot of exploiting Peenemunde and nuclear weapons had paid off. The long range economic plans needed to carry out this policy, however, were not trivial. These were eventually formalized in a seven-year plan approved at the Special Party Congress in 1959.[19] Finally, early the next year, Khrushchev announced to the Supreme Soviet the formation of a new, and preeminent, military service, the Strategic Rocket Forces (SRF)*.[20] The major elements of the Khrushchev/Brezhnev policy were now set in motion.

*Known as Rocket Troops initially, but changed to Strategic Rocket Forces in 1961.

The new SRF quickly became the premier military arm.[21] It was also the focus of all space objectives: scientific, economic, military and political. There was, and is, no genuine NASA equivalent. In spite of all this consolidated power, however, fulfillment of Khrushchev's boasts was still not an easy task. The "hand-built" space spectaculars continued, to be sure, but fielding a truly operational ICBM system was slow in coming. A disastrous launch pad failure in 1960 contributed to this difficulty. Killed were the newly appointed Commander in Chief of the Rocket Forces and a large number of the top space and missile experts.[22] By 1961, the entire operational ICBM force probably amounted to less than a dozen systems, a far cry from the USAF and CIA estimates cited earlier.[23]

Meanwhile, the US had completed deployment of its fourth, and last, Thor IRBM squadron in England.[24] Operational was a force of Atlas ICBMs at least double the size of the Soviet's.[25] Initial deployment of a second ICBM (the Titan) was about to begin, and final development of a solid fueled, rapid response missile, the Minuteman, was approaching completion. Far from the headlines still dominated by Soviet space feats, America's pent-up military space technology was making impressive gains. In addition, improved versions of the B-52 were still coming off the assembly line at a rapid clip, and a new (although overrated) supersonic bomber, the B-58, was entering service. To further compound the imbalance, Polaris submarines had begun their silent cruises of deterrence. For short-term political advantage, Khrushchev's boisterous strategic deception had reaped a massive US response of air, sea and missile hardware. The missile gap, as with the bomber gap, was closed almost before it was opened.

The original Soviet ICBM, the SS-6 "Sapwood," while not deployed in any significant numbers, was continuously refined and used as a space booster. It propelled Yuring Gagarin into history as the first man in space and its descendants remain the Soviet's only man-rated booster.[26] While the missile gap sparked by Sputnik was dispelled by American reaction, the Soviet's impressive accomplishments in space were real. So was their long-term commitment to the strategic uses of space and missile technology--begun in 1945 and reaffirmed by Khrushchev and Brezhnev in 1957.

CHAPTER IV

1969: APOLLO TRIUMPHANT

The first lunar landing on 20 July 1969 riveted the world, as had Sputnik only 12 years prior. It was more than just a triumph of the Apollo program, per se. It was the fulfillment of an idealistic national covenant amid a time of violent disenchantment with Vietnam, the protracted legacy of the cold war. The year was a watershed of national and international political forces, seemingly triggered by the *satori* of the Apollo success.

The scientific and technological forces released in the US by Sputnik and given direction by President Kennedy's Apollo challenge had somehow converged to help make the world seem less cataclysmic, in spite of Vietnam. The Soviets had backed down in Cuba, the missile gap had come and gone, and Western Europe was strong and free. The US had completed a program of installing 1000 of its third generation ICBMs, the Minuteman, into hardened steel and concrete silos. A third of these, by 1969, were the improved Minuteman II version.[1] The Polaris fleet had been completed several years prior, and it, too, now sported improved missiles. Plus, the Strategic Air Command still had 505 operational B-52s.[2] Although the supersonic B-58 was being retired, a small fleet of swing-wing FB-111s was on order, and a new strategic bomber program, the B-1, was rapidly taking shape (a Request for Proposal was issued to industry on 3 November 1969).[3] The science and technology personified by the Apollo landing had made possible a huge strategic arsenal and total confidence in its adequacy. This strategic-space association was, of course, more than just figurative.

America's first manned ventures into space, the Mercury program, were atop the Redstone and Atlas boosters, the military's first IRBM and ICBM. The second manned step to the moon, Gemini, was lofted on a Titan booster, which was the US' second operational ICBM. The boosters used, however, were only the most obvious of the space-strategic connections. The exploding pool of space-related expertise was a continually cross-fertilizing enterprise. Orbital observations of, and reporting by, satellites provided vastly improved mathematical models to better predict gravitational, magnetic and atmospheric effects on trajectories. Better guidance from Cape Kennedy to the moon was obviously not the only result. Similar examples from materials research, structural design, miniaturization, communication, and, of course, computers can be drawn *en masse*. This synergism, moreover, was far beyond merely the expansion of the technically possible; it also influenced the US political perception of what was strategically prudent.

The embryonic military space programs infused with cash by Sputnik and re-emphasized by the U-2 downing in 1960 were now operational. Space "assets" routinely provided weather observation, communications, geodesy, mapping navigation and, most importantly, the functions of missile launch warning and photographic surveillance.[4] As confidence in these systems grew (along with budgetary and political pressures from the Vietnam War), a fundamental shift in US strategic thinking occurred. To illustrate this shift, compare the last 1950s and early 1960s' declarations of "missile gaps," with Secretary of Defense McNamara's conclusion of 1965 that the USSR would, now, not attempt to match the size of the American strategic nuclear buildup.[5] President-elect Nixon, in January 1969, quietly abandoned 20 years of defense policy by substituting an objective of nuclear "sufficiency" versus "superiority" in presidential rhetoric.[6] These two slightly contradictory assertions were, in fact, part of the same shift. The former justified a sharp slowing of investment in strategic nuclear weapons. The second was grudging recognition that deterrence did not require massive superiority. To be successful, both views required the political acceptance of the perception that Russia was no longer the <u>bete noire</u> of years gone by. Hence, the public confidence in American technology, affirmed by Apollo, augmented the confidence, growing in secret, that space assets could preclude any strategic surprise. While these developments made relaxation of tensions with the Soviets a plausible option, the expenses of Vietnam were rapidly making detente the only economically viable option.

The nation was in open political revolt over Southeast Asia. By the time Apollo 11 had completed its historic mission, disenchantment with the foreign and defense policies of the 1950s and 1960s was complete. Defense expenditures, having risen sharply with US involvement in Southeast Asia, had finally started down (in real terms). It was clear that future budgets would bear additional, substantial reductions. For example, the size of the US Army would plummet to less than half of its Vietnam peak.[7] Even the incursion by massive numbers of Warsaw Pact troops into Czechoslovakia would produce little more than a rhetorical US response. By April 1969, the removal from Czech power of the liberal Mr Dubcek was complete, and detente could continue.[8]

The first Strategic Arms Limitation Talks (SALT) were held in Helsinki during November 1969. The momentum leading to this event was considerable. Shortly after the confrontation over missiles in Cuba, the US and USSR agreed to establish better communications to help avoid future misunderstandings. The same year saw agreement that prohibits nuclear testing in the atmosphere, in outer space, or underwater. In 1967, the "Moon Treaty" was consummated which forbids placing weapons of mass destruction in orbit or on the moon. Approval by the Soviets to hold discussions on possible curbs to ABM deployments was secured in June 1968 (immediately after congressional approval of the US Sentinel ABM program).[9] Also in 1968, negotiations on the Nuclear Nonproliferation Treaty were successfully completed in Moscow. Soviet and US Presidents, Podgorny and Nixon, signed this Treaty shortly after the first SALT negotiation session. The day after his signing this Treaty, President Nixon also announced a unilateral decision to destroy all existing US germ warfare stocks and to foreswear any first use of chemical weapons.[10] This impressive momentum, the popular rejection of cold war policies, the economic and political mandates of the Vietnam experience, and the technological confidence born of Apollo, all coalesced to thrust detente into the position of being dominate among US foreign and defense policies. The Soviet Union, meanwhile, was operating under slightly different political stimuli.

The year 1969 was not one of the best for the Soviet Union. While the liberal uprising in Czechoslovakia seemed under control, the possibility of its spreading was of genuine concern. Also, the use of up to half a million Warsaw Pact troops to ensure this control was causing internal strain and was damaging the Kremlin's image abroad.[11] The People's Republic of China was having a propaganda field day over the affair. Exhibiting a policy of recalcitrance borne of joining the nuclear club (PRC's first H-bomb test was in 1967) and the Cultural Revolution, she was damning the Soviets for imperialism over Czechoslovakia. In March of 1969, armed clashes erupted along the Sino-Soviet border in Manchuria. To add to the anxiety of these Sino and Czech developments, poor weather patterns were promising a marginal grain harvest for 1969. Substantial imports from the West, as in 1965, would soon become routine requirements to prevent serious domestic shortages.[12] On top of all these problems, the US had succeeded spectacularly in reaching the moon.

The Soviets had actually dropped out of the manned race to the moon several years earlier. Although Khrushchev, with his appreciation for the dramatic, sought this prize; the necessary hardware was not forthcoming. The huge Proton booster, capable of putting 27 tons into low earth orbit, was still not nearly big enough.[13] Also, its reliability was questionable. A larger booster was under development, but plagued by failure.[14] With removal of Khrushchev from power, Soviet public statements on manned lunar landings as a major goal were given with less and less frequency. Instead, the establishment of large structures in near earth orbit was substituted as the next primary objective. A major achievement in support of this objective occurred in January of 1969 with the docking of Soyuz-4 and Soyuz-5. Cosmonauts transferred back and forth between ships, and TASS heralded the world's first successful space station. In all, five manned Soyuz missions were conducted in 1969;[15] yet, the moon was not completely forgotten.

The Soviets had been the first to photograph the moon's far side with their Lunik III in 1959. To abandon, completely, lunar exploration to Apollo, ten years later, would be a bitter pill. Hence, while emphasizing the development of orbital stations with rotating crews, unmanned probes were committed to "The Race." As Apollo 11 approached its objective, Luna XV was already in orbit around the moon.[16] The hope was to land, scoop up samples, and beat the Americans home. It would have been a significant propaganda coup, too; but it did not succeed. Luna XV crashed, poetically, into the Sea of Crises; and Leonid Brezhnev doubtlessly felt Eisenhower's Sputnik-induced frustration. But, like his opposite number, 12 years prior, Brezhnev knew that things were not quite as bleak as they seemed.

The Soviets learned several lessons from the late 1950s and early 1960s that were beginning to bear fruit by 1969. Foremost of these was that the Khrushchev style of bluster was a two-edged sword: any short-term political gain was likely to be washed away by a massive US reaction. Far better to quietly build one's own military-industrial complex without provoking the capitalist fears. Hence, Khrushchev's fall from power after the Cuban Missile Crisis can be seen as a rejection of style as much as of substantive policy. This conclusion runs afoul of the popularly held view that the Cuba embarrassment resulted in a drastic shift to greater ICBM emphasis. No so. The primacy of nuclear missiles and the long-range economic decisions to implement this strategy were embraced in 1957 and 1959, as mentioned earlier. These plans were refined at the XXII Party Congress in October 1961, a year before the Cuban crisis.[17] While the crisis' aftermath probably thwarted any potential opposition to the cost of Khrushchev's earlier strategic decisions, the crisis itself did not radically change existing plans. If this were not so, it is difficult to see how the chief architect of Khrushchev's strategy, Leonid Brezhnev, could have succeeded him. In a word, Soviet strategic objectives and means did not change--the rhetoric did. So, while the US approached acute schizophrenia over the highs and lows of Apollo and Vietnam, the number of operational Soviet ICBMs drew equal to, then exceeded, that of her adversary.

This rapid buildup of silo-based forces constituted the third generation of Soviet ICBM development: the SS-9, SS-11, and SS-13. Although the rate of deployment was impressive, test firing accuracy (monitored by the US) was not. With CEPs of approximately a mile, most US Minuteman missiles could be assumed to survive a Soviet first strike.[18] But CEPs could be improved, as they had by the US. Therefore, one of these new missiles, the SS-9, was causing severe anxiety among American defense officials. With the ability to hurl a 25 Megaton warhead, its aim did not have to improve by vast amounts. This significant potential, vested in exceeding the total US ICBM deployment, however, was not the only trend in strategic affairs to cheer Mr Brezhnev's otherwise lackluster year.

The US IRBM squadrons in England, Italy and Turkey which had threatened the western USSR had been dismantled several years before.[19] While a like number of Pershing missiles were eventually deployed in Germany, these replacements were of far shorter range.[20] Opposing these, now, was a force of approximately 750 Soviet IRBM launchers, and an even larger number of missiles.[21] Most of these were SS-4s: the type removed from Cuba and the usual booster for the prolific Kosmos Satellite series. Great progress had also been made in air defense. The extensive Tallinn air defense system, partially in use by 1967, was now fully operational.[22] The Soviet Navy, too, was expanding rapidly.[23] A fleet of 30 Yankee class SLBM carriers was well into its production run. The surface Navy boasted a new class of ships: the cruiser helicopter carriers. Not to be outdone, Soviet aeronautical engineers were flight testing a new, swing-wing, supersonic bomber: the Backfire.[24] The across-the-board expansion of Soviet military capabilities, however, did not change the primacy of the Strategic Rocket Forces nor the use of space research as the technical phalanx for future military developments. This space-strategic nexus is best illustrated by two novel uses of the huge SS-9 ICBM.

According to author David Baker, the Fractional Orbit Bombardment System (FOBS) appeared, after introductory propaganda about orbital weapons, in a six-year test series beginning in 1966.[25] Its development was a hedge against US technology arriving at even a marginally effective anti-ballistic missile system, a possibility taken very seriously by the Soviets.[26] Combining orbital and ballistic techniques, the SS-9 would boost a warhead into a low earth orbit, approach its target from the south, then de-orbit from a relatively low altitude. The FOBS would thereby finesse the north-oriented, early warning radars optimized to detect the nominal high-arcing ICBM trajectories. The other new SS-9 system relied even more on previously developed orbital techniques.

The SS-9 boosted anti-satellite system was first successfully demonstrated in October 1968 using Cosmos 248 as a target.[27] The ASAT was launched into a lower, faster orbit than its co-planar objective. Rockets were then fired to achieve at highly elliptical orbit--and a precisely timed swoop-down-explode maneuver at the Cosmos.

The motivation for this development may have initially been the American Dynasoar program. This manned program was purely military and probably deemed by the Soviets as functionally equivalent to a rocket boosted U-2. As such, it would be considered "targetable." Dynasoar, however, was cancelled in favor of a far more elaborate and extended military space presence, the Manned Orbiting Laboratory. The MOL, in turn, fell to budget cuts in June 1969.[28] Continuation of the SS-9/ASAT development after these cancellations, therefore, indicates that the Soviets anticipated and appreciated the growing dependency of the US on space systems even more than the US itself did at the time. The United States had earlier experimented with several approaches to ASAT systems and had established a limited direct ascent capability using the Thor IRBM.[29] Soviet pronouncements concerning orbital weapons, and eventual FOBS testing, were doubtlessly spurring these efforts. The Thor system, however, was not as elaborate as the Soviets approach, and was eventually abandoned as defense and space budgets shrank in the shadow of Vietnam. The Soviets, in contrast, would continue to test their new space weapons, FOBS and ASATS, until the SALT negotiations neared fruition in early 1972.[30]

An aside at this point is necessary to accompany the discussion of the Soviet strategic-space situation of the Apollo period. The American political necessity to cast her adversary as having mellowed and, therefore, less dangerous has already been cited. Apollo induced confidence in US technical capabilities, in general, and in her "national Technical Means," in particular, apparently helped to give this perception of the Soviet Union credibility. The US had (due to faulty intelligence) twice overreacted to cries of "wolf"; surely another bomber or missile-gap would not be possible again. The irony of this contention is that, in spite of the new tools of National Technical Means, a massive failure of American intelligence apparently occurred to the opposite extreme. Depending on which author one reads, 1969 was a year in the midst of a nine to eleven-year stretch of uniformly wrong estimates of Soviet strategic deployments.[31] Each new year would bring hard evidence that the past year's estimates of what the Soviets would actually deploy were too low. Incredibly, the mistake was repeated again and again.[32] Likewise, it was not until 1976 that the figures for Soviet defense spending in 1970 were retroactively revised upward--the original estimates were off by 100 percent![33] Depending, again, on choice of author and economic measurand, around 1970 the Soviet military investment accounts (procurement, RDT&E, construction, etc.) overtook the shrinking US counterpart (see Appendix, figure 2). A year earlier, the total budgets, again in real terms, for equivalent military expenditures crossed: one rising, the other falling.[34]

Even though the full story of this lengthy episode of poor estimates has yet to appear, a conclusion is unavoidable: detente, from the American political perspective, had to succeed; facts contrary to this objective were either ignored or distorted. With this aside in mind, the US and USSR positions going into the SALT/ABM negotiations will now be summarized.

The US was insecure over the survivability of the Minuteman fields vis-a-vis the Soviet SS-9 variety of missiles. The Soviet Union, on the other hand, was anxious over the potential of US ABM technology. Both sides could profit from a relaxation of East-West tensions, in order to better address other pressing foreign and domestic problems. The US knew it still held the overall strategic edge, knew its defense efforts would be dropping sharply and hoped for a halt, or at least a significant slowing, in Soviet military growth. The Soviets also knew the US had the strategic edge, also knew the US had turned anti-defense, but had no expectations of slowing its own growth. Among many "firsts," the SALT/ABM agreements that eventually resulted legalized treaty monitoring from space--as each side's first line of defense--and would have been a strong step towards a safer world, except for two major flaws.

The first, and most serious, was that neither side was willing to seriously address the impending proliferation of warheads. Multiple Independently Targetable Re-Entry Vehicle (MIRV) technology, another example of space-strategic symbiosis, would soon render the SALT I limitations on launch vehicles ineffective. The US began MIRV'ing in earnest in 1970. The USSR followed in 1973 with MRVs, and in 1975 with MIRVs. As a result, the destructive potential of each arsenal would increase sharply, even though deliverable megatonnage (for the US) would drop.[35]

The other flaw was the last minute substitution of language which permitted the circumvention of the basic essence of the ABM and SALT agreements. Stripped to their barest elements, these agreements traded the ABM technology lead of the US for a limitation on large Soviet missile deployments. Each side would be permitted to replace their current ICBM systems, but "light" missiles could not be substituted for "heavy" ones. Specific assurances to this effect were given by the Soviets during the negotiations: the SS-11's successors would not be significantly bigger.[36] The same assurances were passed to the US Senate during hearings on the treaties.[37] The exact wording of the final Treaty, however, stipulated silo, <u>not</u> missile, size as the determining criteria. Exploitation of this loophole by the Soviets, coupled with the MIRV trend started by the United States, would soon lead to treaties legally intact, but essentially worthless due to a failure to reflect political and technical reality.

The myriad of political and technological forces coming into focus during the year of Apollo, 1969, had led to dramatic changes in the postures of the super powers. The Soviet Union emerged from the embarrassments of Cuba and the moon race a less volatile but more determined competitor. The SALT process had effectively removed the American ABM threat, yet had not seriously constrained Soviet strategic modernization plans. The United States, for its part, had managed to transform its foreign relationships to assuage the policy imperatives of its domestic discord. With deterrence safely encoded in SALT, national attention, and budgets, could be diverted to other priorities. As the Seventies unfolded and true strategic parity approached, the central role played by space technology in the East-West drama would continue to intensify--long after the return of the last Apollo mission.

CHAPTER V

1981: SHUTTLE AND SALYUT

The first flight of the space shuttle, Columbia, in March 1981, was correctly labelled as the beginning of a new era--in-space for America. With an initial operational payload capability of 21 tons, planned growth to 33 tons, a huge cargo bay, and a design life of 100 missions, a quantum jump in launch flexibility had been strikingly demonstrated.[1] On the other hand, getting to this high-tech pinnacle was not exactly a foregone conclusion. The advances in thermal protection, rocket engine efficiency and electronics required to develop the shuttle were monumental. The resulting schedule delays and cost overruns had put the entire program in doubt at several times during the late 1970s.[2] Now, however, as Columbia rose to orbit and to a near flawless return, she seemed to carry both US space programs, national security and civil, into a renewed period of vigor and growth. The stayed period thus ending, ironically, had begun with the Apollo success twelve years before.

The political imperatives of 1969 bode poorly for NASA as well as the DOD. While studies of an appropriate successor to Apollo had recommended both a space station and a space shuttle, NASA's budgets were falling rapidly from an Apollo development peak of $5.25 billion to less than $4 billion in 1969.[3] The trend was clear: a new program of Apollo's magnitude was simply not in the fiscal cards. About the time of the cancellation of the USAF's Manned Orbiting Laboratory, NASA decided to postpone its space station plans and concentrate on the shuttle. As the new program began to take shape, budgets, indeed, continued to shrink. By the late seventies, the space budgets of both NASA and DOD were significantly less, in real terms, than in the beginning of the decade, with the bulk of the former's, and a large slice of the latter's, going towards shuttle support or development.[4] As the inevitable technical problems appeared, and resisted resolution, this financial marriage-of-convenience between DOD and NASA grew even stronger. With the Carter administration embroiled over SALT verification issues, the importance of <u>the</u> national launch system to long-term programs of National Technical Means clearly helped in gaining the additional funds necessary.[5] Political and technical forces, moreover, were again converging too soon to direct more favorable budgetary attention to defense and space issues. In 1980, both NASA and DOD space budgets jumped substantially, with DOD getting a larger percentage gain. By the time Columbia was being readied for her maiden flight, the two budgets crossed at a rate of just over $5 billion a year.[6] The reasons for this turnaround, as in 1957, lay in the US perception of its strategic relationship to the USSR.

As expected, the Soviet Union had proceeded with ICBM force modernization following the SALT I accords. Unfortunately, little else followed US expectations. By switching to a cold launch technique, where the missiles are "popped" out of their silos before ignition, these new ICBMs could be made significantly larger than their predecessors and still fit in the SALT-constrained silo dimensions. Hence, the Soviet's "light" ICBM, the SS-11, with a throwweight of 2500 pounds, according to the respected International Institute of Strategic Studies, was partially replaced by the SS-17, with a throwweight of 6000 pounds.[7] Another "light" replacement, the SS-19, used the usual hot launch but required extensive vertical silo enlargement. Its throwweight is even bigger than that of the SS-17.[8] The already huge SS-9s were also replaced, a la the cold launch technique, with the even larger SS-18. Warhead capacity for this "heavy" class of missiles, according to Mihalka, thereby grew by nearly 30 percent--enough for at least 10 MIRVs.[9] In addition, the accuracy of these fourth generation weapons had improved dramatically. All were MIRV capable and all able to achieve CEPs approaching that of the much smaller US Minuteman III ICBM.[10] Finally, to better protect their new investments, the Soviets substantially increased the hardness of their silos and control complexes during this period of extensive force modernization.[11]

As testing of various payload and guidance versions of these weapons progressed into the late seventies, a sobering conclusion became inevitable. Imitation of the US MIRV invention, coupled with the Soviets' penchant for large systems, had completely turned the tables in the land-based ICBM competition. The fewer, "softer," US silos would soon be vulnerable to a first strike; one employing only a fraction of the USSR's ICBM force. Even with its improved accuracy, the smaller Minuteman III warheads were inadequate to similarly threaten the newer, harder, Soviet silos.[12] The significance of this development depends on one's choice of deterrence theory, as the US could still rely on its strategic submarine fleet to retaliate against non-hardened targets. One aspect of this turn of events, however, was unambiguous: the assurances of Minuteman survivability, traded for the US ABM lead during SALT I negotiations, proved worthless.[13]

Soviet missile advances in theater nuclear weapons were also becoming apparent. A Soviet advantage in Europe already existed in this class of weapons with the aging SS-5s deployed during the 1960s. Beginning in 1977, a new system, the SS-20, was being substituted on a roughly one-for-one basis. Not only was the SS-20 solid fueled (fast reacting) and mobile (not easily targeted), it also carried three, accurate, 150-kiloton, MIRV warheads.[14] Hence, each IRBM substitution substantially raised the forces' lethality--and eroded NATO's military confidence. To nervous Western defense analysts, however, these were not the only trends of concern.

Although still less capable than her adversary's, the Soviet Navy was expanding rapidly. Even in the traditional area of American preeminence, airpower afloat, a challenge was forming around a building fleet of Kiev class aircraft carriers. A new Delta class of missile launching submarines was in full production. The improved Backfire B, with an unrefined combat radium of 5500 km, was also in production. Half of these supersonic bombers were being assigned to Soviet Naval aviation, for potential use against Allied shipping.[15] Last, but certainly not least, was the Red Army--backed by staggering amounts of new tanks, artillery, surface-to-air missiles, and air support weapons. Although the US could still claim technical superiority in comparing most classes of individual weapons, Soviet quantity was clearly taking on a quality all its own.

As facts of the Soviet buildup became known, and a Vietnam era sensitivities in the US subsided, the Republicans correctly gauged a growing political vulnerability of the incumbent administration--as had the Democrats under John Kennedy. And, as in earlier era, away from the headlines, significant new military counters were being nursed along, albeit on limited budgets. The paucity of big ticket items, however, made the Soviet additions all the most impressive, and politically damning. For a full decade, the exact numbers of new ICBM, missile-bearing submarine, tank, and bomber systems deployed by the US were all the same--zero. (Of great significance, however, most of the US strategic systems were modified by adding MIRVs, but more on this later.) Defense outlays had fallen in 1976 to their lowest level, in constant dollars, since the years prior to the Korean buildup (see Appendix, figure 1). The Carter administration was sensitive to this growing vulnerability, yet clung to the hope that SALT II would permit keeping a damper on defense spending increases. The international scene, meanwhile, would soon make this altruistic position untenable.

In spite of the historic agreements engineered between Egypt and Israel, the Carter administration seemed destined to reap an increasing tide of red ink on its foreign policy balance sheet. First there were the Soviet-Cuban interventions in Angola and Ethiopia. Then, a pro-Soviet coup in South Yemen in 1977. While worrisome, however, these incidences did not halt the still progressing detente and SALT processes. A treaty limiting underground nuclear tests to less than 150kt had been accepted by both Moscow and Washington since 1976. After years of protracted bargaining, a SALT II compromise was finally reached and put before the Senate for ratification. Negotiations were even underway to curb anti-satellite weapons (Soviet testing of which began again in 1976). These positive signs, unfortunately, were soon overwhelmed by global trends too glaring to ignore. President Carter's hopes for SALT II ratification, for resisting pressures for greater defense increases, and even for re-election, ended abruptly with the double-barreled effects of Khomeini's anti-American hatred in Iran and the invasion of Afghanistan by Soviet troops.

The image of foreign policy and defense weakness ascribed to Carter was politically effective, although not completely justified. He had, in fact, raised defense spending from its trough of 1976; and, with the help of Afghanistan, finally acknowledged the seriousness and breadth of the Soviet military momentum. Jimmy Carter also permitted the continued development of several new defense systems, each squarely on the space-strategic nexus.

The Carter administration's connection between space shuttle development and National Technical Means, cited earlier, is a case-in-point. After all, something had to be providing the information to assess the strategic implications of the prolific Soviet military-industrial complex. The "something," while finally confirmed as satellite surveillance by Carter in 1978, has never been addressed in any detail by the government, but, rather, left to the speculations of the press and unclassified technical memos.[16] Fact and fiction have, no doubt, mixed in many of these accounts; yet, it is obvious that space surveillance must have matured to surprising performance levels by advent of the shuttle. If this were not so, "National Technical Means" would not have been so importantly treated in the SALT I Treaty, almost a decade before.

Two other systems which progressed in development under President Carter would use the growing sophistication of space science for more direct military utility. The first, the cruise missile, profited from many aspects of miniaturization that had been nurtured by years of space requirements. The lethality of the system, in particular, depended on a revolutionary use of space-gained geodesy. By comparing the actual variations in the height of the ground under its path with a computer-stored version of the anticipated variations, the cruise missile could calculate extremely precise course corrections.[17] As the Soviets could hardly be expected to provide the necessary 3-D terrain information for this purpose, it had to be obtained by satellite.[18]

With its ICBM force growing more and more vulnerable and the serious doubt of the ability of the B-52 bombers to evade the massive Soviet air defenses, the cruise missile offered the US a relatively cheap means of upgrading its aging nuclear strike forces. This logic was also appealing to NATO, as a counter to the unmatched Soviet SS-20 deployments. In December of 1979, NATO announced its now famous "two-track" decision: 1) negotiate with the Soviet Union to reduce the intermediate range missiles aimed at Europe, and 2) deploy 464 cruise missiles and 108 Pershing II IRBMs as a counter to the larger Soviet force and as an incentive to negotiate.

The other military enhancing systems that advanced in development under Carter was the NAVSTAR Global Positioning System (GPS). When fully operational in the early 1990s, this system of 18 satellites, evenly space within six orbital planes, will provide unprecedented time and position accuracy on a truly global basis. The commercial applications of a navigation and time standard of this type are enormous; so is the military potential. With access to the satellites' most accurate (and encoded) signals, continuous position fixes, in three dimensions, within 16 meters, are anticipated. Due to a special feature of these signals, they are also inherently jam-resistant. If GPS receivers are integrated with missile and ordinance delivery systems, fixed targets such as silos, control bunkers and bridges will suddenly become more vulnerable, a lot more vulnerable. Computer simulations, although not acknowledged as official by the DOD, have predicted that a GPS-guided Minuteman could reduce aiming errors to tens of feet.[19] The potential for improved military effectiveness, if not expressed in feet, has been officially acknowledged.

General Chain, as CINCSAC, credits GPS with the ability to improve conventional bombing accuracies by a factor of four.

With such space-borne advances, in final development, the new Reagan administration was not without strategic options. More importantly, the nation's political forces were aligned to fund many of these options. In yet another coincidence of political deja vu, examples of which keep appearing throughout this discussion of 12-year space cycles, Ronald Reagan was elected in a year with the same constant dollar value obligated to national defense as in the year John Kennedy beat Richard Nixon. Defense investment spending (R&D, procurement, etc.,) was actually larger by several billions in 1960 than in 1980 (see Appendix, figure 2). Both men won on pledges of strengthening America.

Ronald Reagan's first year in office, as advertised, was dominated by national security considerations. As 1981 progressed, plans emerged calling for sustained increases in practically every facet of the DOD budget. The Soviet Union, meanwhile, co-operated by providing continuous reminders of its threatening rivalry. Approximately 100,000 Soviet troops were now in Afghanistan trying to suppress the native forces, and the number of SS-20 launchers deployed against NATO had increased to well over two hundred.[20] The Backfire B, an improved version of the prototype first seen in 1969, was now being produced at 30 per year. In addition, and in keeping with the coincidental 12-year space cycle, a new strategic bomber, nearly 40 percent bigger than the Backfire, was spotted at the Ramenskoye test center--reportedly seen by "Nation Technical Means."[21] Further to the west, Warsaw Pact maneuvers punctuated the rising tensions in, and about, Poland. Marshal law was eventually declared in December 1981. Soviet maneuvers on earth, however, were not the only ones being monitored by the West. Although partially eclipsed by the spectacular success of the shuttle, 1981 was also a landmark year for the Soviet's space program, and for their Salyut space station, in particular.

In the wake of Apollo successes, the building of near earth cosmodromes had become the long-term objective of Soviet space research. Flights of greater distance were not forgotten, but postponed, pending the establishment of routinely accessible space stations--as predicted by the Soviet mathematician and visionary, Tsiolkovskiy, at the turn of the century.[22] With rendezvous and docking techniques repeatedly demonstrated in 1969, prototype experimental stations could now be constructed and launched as the next step. Tragically, the Salyut (meaning "salute") program began with the death of three cosmonauts, as had Apollo, due to poorly considered design decisions.

Ten years to the month after Yuring Gagarin's first orbital flight, and the same interval prior to Columbia's winged mission, Salyut 1 was launched by a Proton booster from the Baykonur Cosmodrome at Tyuratam. Weighing 1900 tons, this orbiting experimental station was 16 meters long, just over 4 meters in diameter, and sported four large solar panels for power.[23] The largest of its three sections, the central work area, was 9.1 meters long and was sandwiched between the forward docking portion and the rear service module. After a preliminary rendezvous and external inspection by the crew of Soyuz-10, three cosmonauts were launched towards the station aboard Soyuz-11 on 6 June 1971. They successfully docked, entered, then lived and worked in Salyut for 23 days. Besides testing the station's basic operating systems, a host of biomedical, astronomical and earth observation experiments were conducted. Finally, the three separated their Soyuz ferry vehicle from the Salyut station and headed home. Without space suits, due to the earlier political decision made by Khrushchev to "outman" the US Gemini capsule, they were unprepared to meet a fatal mechanical glitch. They arrived, dead-in-their-seats, due to a failed cabin vent valve.[24] More than two years would pass before another manned Soyuz would fly (re-designed for two cosmonauts <u>with</u> space suits), and three years before another Salyut was occupied (an earlier Salyut launch attempt failed).

Salyut-3 was launched in June 1974, and Soviet space fortunes changed dramatically. Crew after crew occupied a series of evolving Salyut stations, conducting experiments ranging from space welding to earth observations with multi-spectral and 10-meter focal length optics.[25] The principal experimental device, however, was man himself. Determining the capabilities, and limitations, of man-in space, plus developing better and more self-sufficient life support systems have become unrelenting, long-range objectives. Dozens of cosmonautics (including non-Russians via the Interkosmos program) gained years of on-orbit experience. One of these, Valeriy Ryumin, spent 360 days aboard, out of a 594-day period, on two consecutive trips. By the time the sixth Salyut was retired in late 1981, after four years of nearly continuous occupancy, an impressive mix of hardware sophistication, access frequency and mission flexibility was being routinely practiced.

Salyut-6 was a refined version of the early station configurations. It was heavier, weighing 21 tons, had improved suntracking solar panels, delivering 4 kilowatts of power, and had improved electronics; and, most impressive of all, it could be refueled. The station was modified to handle two dockings, simultaneously, and plumbing added to transfer propellants from a new cargo-tanker supply ship to the altitude-propulsion system.[26] The new cargo ship, appropriately named "Progress," was really a highly modified and automated Soyuz vehicle, sans crew or re-entry equipment. Hence, Salyut occupants could now count on automatic dockings, with delivery of 1000 kilograms of fuel and oxidizer to feed the orbit adjust motors, fresh water and up to 1300 kilograms of miscellaneous "bulk" cargo, without disturbing their already docked Soyuz return vehicle.[27] This was indeed progress.

The manned Soyuz design was also highly modified for the Salyut-6 mission. Its improvements included better and more compact navigation, computer, and communications equipment and totally new space suits. These advances also permitted the safe return to a three-man crew configuration. However, modifications to older vehicles, impressive as these were, were not the only surprises offered by Salyut-6.

On April 24, 1981 (twelve days after the completion of the shuttle's maiden voyage) a heavy Proton booster was launched from Tyuratam; it carried Cosmos 1267. Being launched by the Proton, however, hinted that this new satellite was not of the ordinary Cosmos variety--it weighed, according to the Western media, over 15 tons. After 57 days of extensive orbital maneuvering, Cosmos 1267 rendezvoused with Salyut-6, docked, and then performed maneuvers with the combined 35-ton complex.[28] It was now clear that, as indicated by its booster, the vehicle was definitely not just another Ccsmos, nor was it another Salyut. Analysis, and speculation, issued in Aviation Week, and elsewhere, imputed the new vehicle of possessing ports to eject miniature sub-satellites of unknown purposes.[29] Others posited it as a prototype space tug or as a module for larger, permanent stations.

According to the Salyut program Mission Director at a press conference announcing the Salyut 6-Cosmos 1267 docking: "The coupling of the two vehicles is a significant step towards the construction of large orbital operations centers."[30] He also explained that Cosmos 1267 had several docking areas, complete electrical, thermal and life support systems and could serve as a "launch pad" for other missions. No mention, however, was made of the speculated ejection ports, nor of the capsule ejected just prior to its docking; nor of any connection to an earlier Cosmos flight (now believed by Western analysts to be a Cosmos 1267 precursor) which also, according to Aviation Week, ejected a small, maneuvering object.[31]

Regardless of this mystery, one fact was indisputable: the Soviets were serious about mastering near earth space and its potential for the various elements of national power. Theirs was not a series of isolated, media-intensive ventures, but a determined effort aimed at establishing a utilitarian, high-capacity space infrastructure. Through 1981, the Salyut program claimed: 23 successful manned docking maneuvers, 15 successful unmanned dockings, the training in space of 46 cosmonauts, and a decade of experience with practically every conceivable type of on-orbit experiment.[32] The cost of the program has been equated to the sum of the US Mercury and Gemini programs, plus all the Apollo development and moon flights.[33]

Meanwhile, other aspects of the Soviet space program were also progressing at a rapid pace. Satellites for surveillance, attack warning, communications, navigation, meteorology, and geodesy were being launched at a record rate. While most of these still lacked the technical sophistication of their US counterparts, the total Soviet system had compensated for this weakness with mass. During 1981, the Soviet Union launched over 100 payloads, of which at least 75 were for defense purposes. In contrast, only 8 out of 18 payloads had military missions from the United States.[34] While this difference might not be significant during normal periods, it highlighted a glaring lack of US surge capacity during times of tension. This deficiency was even more serious when viewed in light of the renewed Soviet ASAT tests, two of which were also conducted in 1981.[35] Then, too, reports of impending breakthroughs by Soviet researchers in beam weapons, and their linkage to space activities, contributed to a growing suspicion that the US had somehow slept through the latest round of the space race. By the end of the year, and in spite of two successful shuttle flights, the contrast of the perceived US-to-Soviet efforts was giving rise to many questions as to the adequacy of the national security side of the US space program.[36]

The Reagan administration, in its initial review of strategic programs, recognized the tenuous nature of the existing US communications and monitoring resources, and that spelled the need for a closer look at the total US space program. A study group, chaired through the White House Office of Science and Technology Policy was tasked to provide policy recommendations.[37] Congress and the media were also becoming heavily involved in the issue with suggestions ranging from crash programs on exotic space weapons to formation of a separate military space service.[38] As the dust began to settle, some clearly delineated policy guidelines started to emerge. Foremost of these were: 1) the reaffirmation of the dual nature of the US space program, civil and national security; and 2) the recognition that space access and assets were essential elements of national defense, and would be treated accordingly.[39] In other words, and in the historical context of this discussion, the lean Seventies were over and the strategic-space nexus could come back out of the US political closet. Like it or not, both super powers now saw space as entering a new era of increased influence on worldly affairs.

It is, therefore, appropriate that 1981 was a landmark year in the space program of each super power: one with the shuttle, the other with Salyut. And what of Mr Clarke, who advanced those incredible ideas about geostationary satellites back in 1945? At 1981's end, he was assembling the final corrections to his latest novel, 2010: Odyssey Two, at his home in Colombo, Sri Lanka--preparing to transmit them via the IntelSat V communications satellite to his publisher, half a world away, in New York.[40] A use of space now considered routine, and a tribute to Mr Clarke's fertile imagination which foresaw this potential precisely three, 12-year cycles before.

CHAPTER VI

TRENDS AND DOCTRINE

After the 36 years of strategic rivalry described thus far, the US and the Soviet Union had embarked down distinctly different paths. Each had evolved its own separate strategy and doctrine (in deed, if not in words) for the exploitation of space for national security purposes. Before progressing to the present, these different appraoches deserve further elaboration.

The US was pressing its strong suit of computers, materials fabrication and electronic sophistication. As a result, it was now fully dedicated to an increasingly more complex, and individually capable, system of satellites and associated support. The accumulation of this sophistication, however, was leading to fewer and fewer assets of ever higher value. When everything was working "nominally," these space assets performed as a system of great flexibility; one capable of handling diverse peacetime demands. Yearly costs were kept manageable and individual satellites were frequently lasting longer than their design goals.

On the other hand, single-point failure nodes were becoming apparent in this high-tech approach. Few payloads and launch vehicles existed for rapid replacement of unanticipated failures. The command and control portions of the overall system were becoming saturated. Finally, the shuttle was becoming the sole means for the US to get into space[1]--a failure of either the shuttle itself, or of its single pad, could cripple the entire space program. The US doctrine and strategy for space had become, de facto, driven by two imperatives: make the shuttle viable by excluding launch competition, and establish force levels based upon budgetary constraints instead of military operational requirements.

In contrast, the Soviets were pursuing a course characterized by long production runs, redundancy at all levels, and relatively low technical sophistication. Her space doctrine, borrowed from her more conventional military forces, had clearly been driving the programmatic decision process. This doctrine can be paraphrased as: build reliable, deployable assets in quantities sized to warfighting needs.

As a result of this doctrine, individual payloads would be shorter-lived, and less capable than their US counterparts; but, they could be quickly augmented by new launches, from multiple sites, to offset these drawbacks. Few, if any, single-point failure nodes would exist. Additionally, the Soviet space program had become far more man-intensive and terrestial-combat supportive.

While the US largely abandoned its military man-in-space efforts following the demise of the MOL program, the Soviets slowly, but consistently, expanded their own. The near-permanent manning of the Salyut space stations has been largely attuned to military experimentation.[2] Space surveillance and, if necessary, targeting of allied forces from space have become operationally integrated with earth-based forces.[3] Unmanned imaging systems were also incrementally improved, as have her orbiting electronic intelligence (ELINT) assets. Examples of the latter include the radar ocean reconnaissance satellite (RORSAT) and ELINT ocean reconnaissance satellite (EORSAT). These payloads were specifically designed to locate naval forces for targeting by antiship weapons.[4]

The most striking contrast between the Soviet and US approaches to space, however, deals with gaining and controlling space access. While continuing high levels of production of a large stable of proven boosters, advanced development was begun in the early 1980s on a whole new family of launch vehicles. The SL-16 is roughly equivalent to the US Titan 34D with a low earth orbiting capability of 15,000 kilograms.[5] With its small, reusable space plane, also under development, it is reminiscent of the long-cancelled US Dynasoar programs.

Following the SL-16 in development is the dual configurable SL-17. This enormous booster will carry the Soviet's version of the space shuttle into orbit with a payload capacity at least as great as that of the US shuttle. In its unmanned version, the SL-17 becomes a Saturn-class heavy-lifter able to orbit approximately 100,000 kilograms.[6] When the SL-16 and 17s become fully operational in the 1990s, the Soviet's total launch capacity, already double the US' in the early 1980s, will more than triple.[7]

The Soviet's commitment to dominating space access, as noted earlier, has not been focused solely on their own payloads. The orbital interceptor ASAT, operational since the early 1970s, has been refined over the years and postured for warfighting launch rates. While the US struggled to fund and develop its own ASAT, two separate ASAT facilities at Tyuratam were being outfitted. With storage for many launchers and weapons, several interceptors a day could be launched from each of these pads.[8] In keeping with the Soviet's doctrine, a backup also exists for this already robust capability. The ABM interceptors deployed around Moscow have an inherent ASAT capability that could add to US space problems in time of conflict.

In summary, the Soviet approach to space that has emerged is one of mass, flexibility, and sustained commitment. Or, as stated in the excellent "Soviets In Space" feature article in National Geographic, October 1986:

> Their strengths . . .lie in their methodical, building-block approach and breadth of their commitment: strong military and manned programs, imaginative space-science goals, and a busy launch schedule--all while developing a shuttle and medium- and heavy-lift rockets.

The US, meanwhile, was approaching a crisis due to its sophisticated, yet increasingly fragile, high-tech, low-volume space architecture.

CHAPTER VII

THE CURRENT SITUATION--IN PERSPECTIVE

Since the pivotal year of 1981, a number of major events that will further shape the strategic and space plans of the US and the USSR have occurred. For the US, and by far the most significant for either side, have been the Strategic Defense Initiative (SDI) and the Challenger disaster.

On 23 March 1983, President Reagan took the world by surprise in announcing his "vision" of a world less dominated by the threat of nuclear weapons. In what was immediately dubbed as the "Star Wars" speech, a workable defense against ballistic missiles was proffered, although hedged as being a very long-range research objective. It was, in a sense, recognition of on-going US efforts, much of which was laid out in surprising detail in the unclassified "Fiscal Year 1983 Research and Development Program," of the Defense Advanced Research Projects Agency. This document was released on March 30, 1982, a year before the President's speech. Of these research efforts cited, "high-efficiency infrared chemical lasers, large space optics, and pointing and tracking techniques to demonstrate the feasibility . . .for space-related applications," must have played a role in the President's thinking.[1]

Reaction to "Star Wars" was voluminous and predictably polarized. Some received it as a sane and overdue modification of current, offensive-force dominant, deterrence policy--a move away from a bankrupt doctrine of Mutually Assured Destruction (MAD). Others saw the President's goal as an ill-advised boondoggle and potentially destabilizing. Still others warned of raising false hopes of a "perfect" defense. Most, however, conceded that the speech did correctly characterize an accelerating body of multi-disciplined research, which was forcing a reevaluation of ABM viability. Regardless of one's affinity to the speech, its results on two aspects of the political discourse about space and defense should be noncontroversial. First, the speech publicly verified what technocrats had been forecasting for years: in-space operations were entering a new era of increased strategic importance. Second, it forced public recognition of the fact that the US is currently defenseless against any form of missile attack. While this second statement will border on the boringly obvious to those closely associated with defense issues, it reflects an uncomfortable confrontation with reality for most Americans. In spite of the heavily publicized ABM debate and the eventual, unilateral, dismantling of the sole US ABM site, a vast majority of Americans believed that some form of ballistic missile defense was operationally in-being.[2] The flurry of debate caused by the President has done much to dispel this illusion. As for the Soviet Union, its reaction to the speech was characteristically one of self-righteous indignation.[3]

The Soviet Union, as permitted by treaty, never abandoned its ABM system, deployed around Moscow. Although the number of older Galosh ABMs actually in place has steadily decreased, a decade of research has led to large-scale upgrading of the system's battle management facilities, the fielding of improved Galoshes, and the testing of a new, silo based, surface-to-air ABM.[4] Although capable of being overwhelmed by a US attack, the emerging Moscow system would be of great value in countering smaller raids--say from China, France, or Britain.[5] "Star Wars" variants to these improvements have also been under development since the mid-70s. High energy laser and particle beam research have enjoyed a high Soviet priority and constitute programs several times the scale of current US efforts.[6]

The importance of the new Soviet generation of space boosters was not lost amongst these revelations about "Star Warski." Coupled with their vast Salyut on-orbit experience, these advanced launch systems could clearly be married to the high-tech weapons being researched. To complement this potential, modification and expansion of launch complex, command and control, tracking, test, and space hardware production facilities are also underway.[7] In light of this activity, official rhetoric aside, it can be seen that far greater national emphasis on space was being planned by the Soviet Union, as well as by the United States.

The second significant event impacting the space-strategic connection occurred after nearly five years of successful Shuttle operations. On 28 January 1986, the highly publicized flight of the Shuttle, Challenger, ended in disaster shortly after liftoff. The explosion, viewed in horror by millions on live television, killed the entire crew--and with them, the complacent, single-means-to-space US strategy and doctrine.

After an understandable period of introspection and self-doubt, a sharp policy reversal has occurred which is re-shaping US space planning. This process was accelerated by the loss of two unmanned Titan 34D missions very close in time to the Challenger explosion. Instead of ending all expendable launch vehicle (ELV) operations in 1990, as previously planned, a far more robust launch program is now being constructed. In addition to re-building the shuttle fleet with improved safety considerations, ELVs will once again be used in a major US role. This launch recovery program now consists of a new, heavier, Titan IV booster, production of Titan IIIs for commercial use, a medium sized booster for GPS and military communications satellites, and expanded launch and support facilities. In addition, work has begun towards a future, advanced launch system (ALS) for even larger payload requirements.[8]

The Soviets also have had several space events of note since 1981. The new SL-16 booster, comparable to our Titan 34D, was declared operational. The super-heavy-lift SL-17, reportedly with a fully weighted payload mockup, was successfully tested on 15 May 1987.[9] The Soviets also continued their highly successful space station program. In 1986, they launched and began long term occupation of the upgraded successor to Salyut-7, named "Mir," which means "peace" in Russian. Like its predecessors, Mir's mission is largely military.[10]

The Soviets also experienced a major policy change during this period, but on the strategic side of the ledger. Under the new leadership of Mikhail Gorbachev, the USSR was able to remove several long-standing obstacles which had stalemated theater arms control talks with the US. The result is the Intermediate Nuclear Force (INF) Treaty which was signed on 8 December 1987.

If approved by the US Senate, this treaty will completely remove SS-20, GLCM and Pershing II class weapons from the European theater. It will also, according to Western critics, exacerbate the decades old problem of superior Soviet conventional forces in the theater. Regardless of how INF, or Star Wars, might eventually impact military planning, however, the principal strategic problem of here-and-now continues to be one of warhead proliferation.

The United States, beginning in the late 1960s, MIRVed 550 of its ICBM force with triple-warhead Minuteman IIIs.[11] Just over two thousand targets were thereby held hostage by the total US ICBM force--assuming all missiles survived to launch. The newest US ICBM, the MX, continues this trend and could potentially add an additional 1,000 MIRVs from 100 missiles by the early 1990s. Significantly, Congress has refused to fund more than the 50 now being fielded.

The Soviet Union, with newer and heavier operational boosters, has MIRVed to a much greater degree than the existing US force, resulting in over 6000 targets held at risk.[12] Two new Soviet ICBMs, both mobile, the SS-24 and 25, would presumably add to this amount.

An inverted East-West situation exists for submarine launched missiles. The United States has completely MIRVed its deployments of these weapons; hence, the Poseidon and Trident boats now operational carry nearly 6000 re-entry vehicles (RVs). The Soviet fleet, even with a larger number of submarines (62 modern hulls per SALT-1), currently supports just over 3000 RVs.[13] If current trends continue, the numbers on both sides will grow even greater, especially for the Soviet Union.

The Soviets have launched five of a new production class of missile-firing submarines. These Typhoon class boats, in addition to being by far the biggest things ever to blow ballast, each carry 20 appropriately large and MIRVed SS-N-20 missiles.[14] Each Typhoon will carry up to 180 warheads, and as they replace older boats equipped with few or no MIRVs, the total RV count of the Soviet fleet will rise rapidly. Warhead count will also grow for the US as more air-launched cruise missiles (ALCM) are deployed to operational units. One hundred and fifty-four B-52s are scheduled to become ALCM carriers.[15] This aircraft "MIRVing" greatly increases the lethality of each B-52 not destroyed in an initial raid.

The Soviets are also deploying long-range ALCMs; so, as with missile MIRVing, bomber MIRVing will eventually work for both sides. As MIRVing continues on land, sea and air systems, on both strategic and theater forces, the number of individual strategic nuclear warheads deployed by East and West can easily exceed 10,000--each.[16]

The purpose of this last paragraph is not to simply emphasize the dangerous nature of the global competition. It is, rather, to note that the strategic nuclear calculus has, along with space utilization, entered a different and more complicated era. The many interrelationships of these complications are by no means universally acknowledged. To make matters even more vague, the warhead numbers cited, along with companion figures available for silo hardness, submarine on-station rates, air defense effectiveness, etc., can be juggled to "prove" practically every philosophical predilection of the nuclear debate. The underlying truth, however, rests in the shear number of nuclear weapons that have grown steadily in the name of parity.

After more than a decade of SALT, it is difficult to argue that East-West relations are now more stable. Nor is the West now in a better position to resist Soviet pressures than was the case in the late Sixties or early Seventies when each side possessed "only" a few thousand RVs. The bitter pill is that the thousands of extra warheads have produced little military advantage for either side and, due to their increasingly counterforce nature, have moved Mutually Assured Destruction into an environment of grave uncertainty in times of crisis.

This is an unsettling, but necessary, backdrop from which to proceed. In conjunction with this backdrop, a distillation of the nodal space-strategic years of 1945, 1957, 1969, and 1981 will be presented.

CHAPTER VIII

CONCLUSIONS, FORECASTS AND A FINAL NOTE

By the historical perspective presented, the preeminent role played by strategic military considerations in the exploration and exploitation of space has been demonstrated. While exciting objectives of purely scientific nature have had their undeniable influences, national power in the form of direct military capability (or its sublimated alter ego, international prestige) has always been the principal driving force behind any major budgetary commitments and the resulting technical advances. The importance of this space-strategic nexus is not likely to diminish. It will, in fact, broaden in scope as the economic elements of national power become more and more closely associated with space activities. This eco-strategic merging is evidenced by the growing commitments to: expanded space access, permanently manned space stations and world internetting via communication satellites. The mutually reinforcing trends in these technical areas will lead to an unfamiliar era of surprisingly few technical constraints. The space planner of 1993 will surely be as vexed with financial ceilings as those before him; but his project, of whatever sort, will not be as frustrated by the traditional problems of: how to lift it, how to break its data processing logjam, and how to communicate with it. The world, as a result, will be a different place.

Before venturing any further into the future, however, several more specific historical distillations are warranted. The degree to which these conclusions continue to be valid will greatly influence which of the many future possibilities become reality.

HISTORICAL CONCLUSIONS:

1. The Soviet Union correctly ascertained the potential of space and rocket research as instruments of national power immediately following World War II. Following the ICBM proof-of-concept flights in 1957, Politburo decisions have been repeatedly made to exploit this potential with ever-increasing resources. The hallmarks of the Soviet space program have been commitment consistency and adherence to the principles of mass and flexibility. No evidence exists to suggest that this pattern will change.

2. The United States has alternated several times between extremes of indifference and infatuation in its concern for space and strategic issues since World War II. Without a pervasive set of active political imperatives, vacillation on these matters appears ingrained in the American system.

3. The original precepts for NATO's strategy of defense-on-the-cheap are null and void. There no longer

exists a Western nuclear advantage available to offset superior Soviet conventional forces. If any meaningful advantage does exist today, it lies with the Soviet Union.

4. Two corollaries to 3, above:

   A. In a short-sighted attempt to preserve the US nuclear margin, failure to include MIRVs under the SALT I agreements was a lost opportunity of tragic proportions.

   B. The marginal gain of traditional nuclear systems is gone. While modernization will no doubt proceed to preclude block obsolescence or numeric dominance by one side or the other, additional deployments will produce no additional security.

5. Although not for reasons totally pure, the United States did give detente and strategic restraint a genuine try during the 1970s. Unfortunately, the American view of sufficient, <u>and</u> <u>secure</u>, nuclear forces, able to maintain the world order via a stable deterrent, was not shared by the Soviet Union. While current signs of US and Soviet accord on these issues are promising, it remains to be seen if meaningful reductions can be achieved and maintained.

6. Whether addressed directly, or decided by default, a major geopolitical decision awaits the United States. If the traditional European ties are to be maintained, a

substitute for the nuclear-based defense-on-the-cheap must be found, or the theater imbalance of conventional forces must be corrected.

With these conclusions, and the problem of warhead proliferation in mind, a speculative peek into the potential that space might play in future national security planning will be attempted.

FORECASTS:

After focusing on the perspective afforded by studying the nodal years: 1945, 1957, 1969 and 1981, the natural inquiry is: What's in store for 1993? Many tempting conceptual systems are candidates for this distinction, each worthy of technical, economic and political exploration, each tempting in order to yield specific prophesy. Laser-armed, orbiting, anti-satellite space stations are a contender. So is a prototype space factory and on-orbit serving station. Manned, military command centers in space? Anti-shipping battle stations? Kinetic-kill SDI satellites? Each of these may well prove feasible, and, eventually, even practical; but their individual investigation might detract from the broader, and more important, technical trends upon which the viability of these candidates ride. Hence, a less specific, functionally-oriented set of forecasts is offered. (This device also lessens the embarrassing chance of being proved dead-wrong in the years ahead.)

1. Sensing From Space - Targets of military significance that move, radiate or reflect will be detected and tracked from space. By integrating the data from sensors using various portions of the electromagnetic spectrum, and by allocating the use of these sensors to meet changing conditions, detection and tracking will be an all-weather, day or night proposition.

2. Force Application - Due to the dual potentials of space-derived navigation and advanced homing techniques, undefended land targets, and slow moving sea and air vehicles will become increasingly vulnerable. Miss distances at intercontinental range will be measured in 10's of feet. In conjunction with high-tech terrestrial systems, space assets will offer the potential for replacing the defunct defense-on-the-cheap strategy of countering, with nuclear weapons, the superior Soviet conventional forces in Europe. While these systems will not be "cheap" by any definition, they will offer several advantages. Conventional forces would be countered with less risk of escalation. They would permit replacing nuclear warheads with conventional munitions against several classes of targets. They will eventually cost less than matching the Soviets tank-for-tank. Finally, such a strategy plays to the West's strongest suit, computer technology.

3. Economic Power - Led by demands for earth sensing, information internetting, and later by manufacturing, earth management and possibly power production, space will become an essential aspect of continued economic growth in the industrialized nations. Space-directed research will continue its role as the leading edge of new technology, with ever-broadening economic application.

4. Battle Management - Computers endowed with artificial intelligence, linked via comsats with ground, air and space sensors will fuse data and analysis to help dispel the proverbial fog of war. The timeliness and extent of this information will be such that the inertia of committed forces will yield a decided advantage to a defensive force possessing superior communications.

5. Space Defense - Active defense against ICBMs will no longer be computer-limited ~~linked,~~ as it was in the 1970s. Of the several techniques being discussed in technical journals, at least one will prove to be technically sound. Deployment decisions, however, will hinge on strategic arguments as to the meaning of system effectiveness goals, and economics, instead of technical feasibility.

A FINAL NOTE:

Space technology and applications are not the end-alls and be-alls required to solve America's security problems. No fleet of future space shuttles will ever replace the need for credible forces of the more conventional variety. To pretend that mastery of this newest medium is without pre-eminent strategic considerations, however, is both dangerous and unsubstantiated. By every classical military definition, space _is_ the high ground. Through it, or from it, space has the potential to dominate the other media of land, sea and air. By their actions, the Soviets clearly have embraced this new principle of war.

This does not mean, however, that traditional military doctrine should be transferred blindly to space. Specifically, the deployment of offensive weapons _in_ space capable of directly attacking earth targets should be avoided. The MIRV mistake of the past decade must not be repeated. The military potential of space for checking Soviet pressures lies in making the utility of space assets available on short notice to the individual field commanders. _Space planning should be global in reach, but tactical in application_.

To capitalize on this potential, a more farsighted and consistent view of the economic and strategic importance of space, and of its driving role on America's scientific and technical leadership, is necessary. Replacing defense-on-the-cheap and assuring American competitiveness demands a long-term commitment to space superiority--not parity, not sufficiency, but clear leadership. The rollercoaster national commitment of the past two decades must be replaced by a policy of steady and energetic dedication to expanding space utilization. Arguing on the side of "dedication," particularly at this point in US history, have been the two major themes of this paper:

1. Space exploitation is both the catalyst and leading edge of military technological competitiveness.
2. Space leadership is one of the better options available to counter 43 years of Soviet military expansion.

The tools and techniques of the Space-Strategic Nexus are changing. Its importance has not.

APPENDIX

Chart 1 ... DOD BUDGET - Constant Dollars

Kanter, Hershel, "The Reagan Defense Program: Can It Hold Up?", Strategic Review (Spring 1982): p. 22.

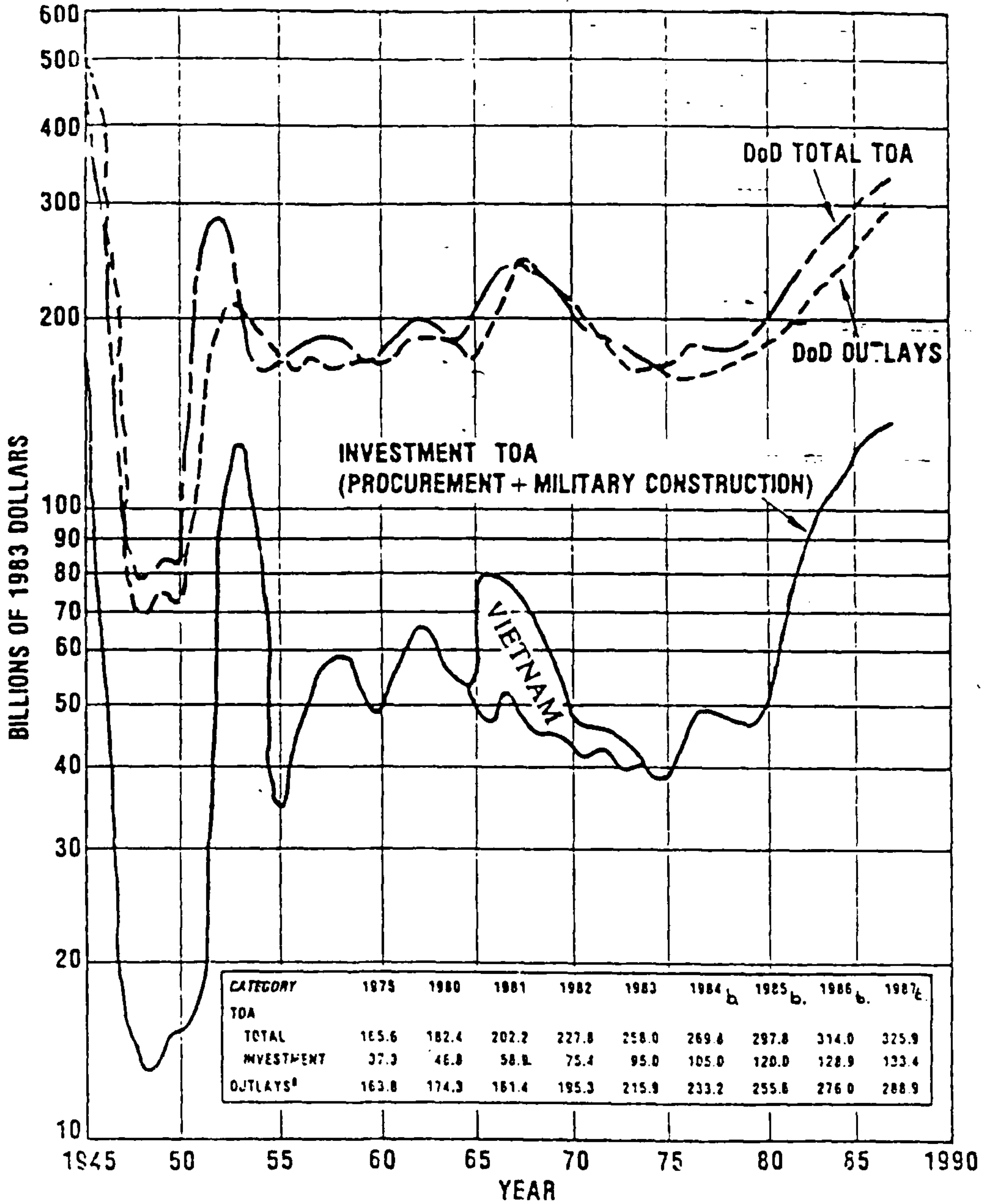
Chart 2 ... US / SOVIET DEFENSE INVESTMENT

Dept of Defense, Annual Report to the Congress - FY 1989, Washington, USGPO, 18 Feb 1988: p. 21.

FIGURE 1

DoD BUDGET-CONSTANT DOLLARS, 1945-1987

BILLIONS OF 1983 DOLLARS

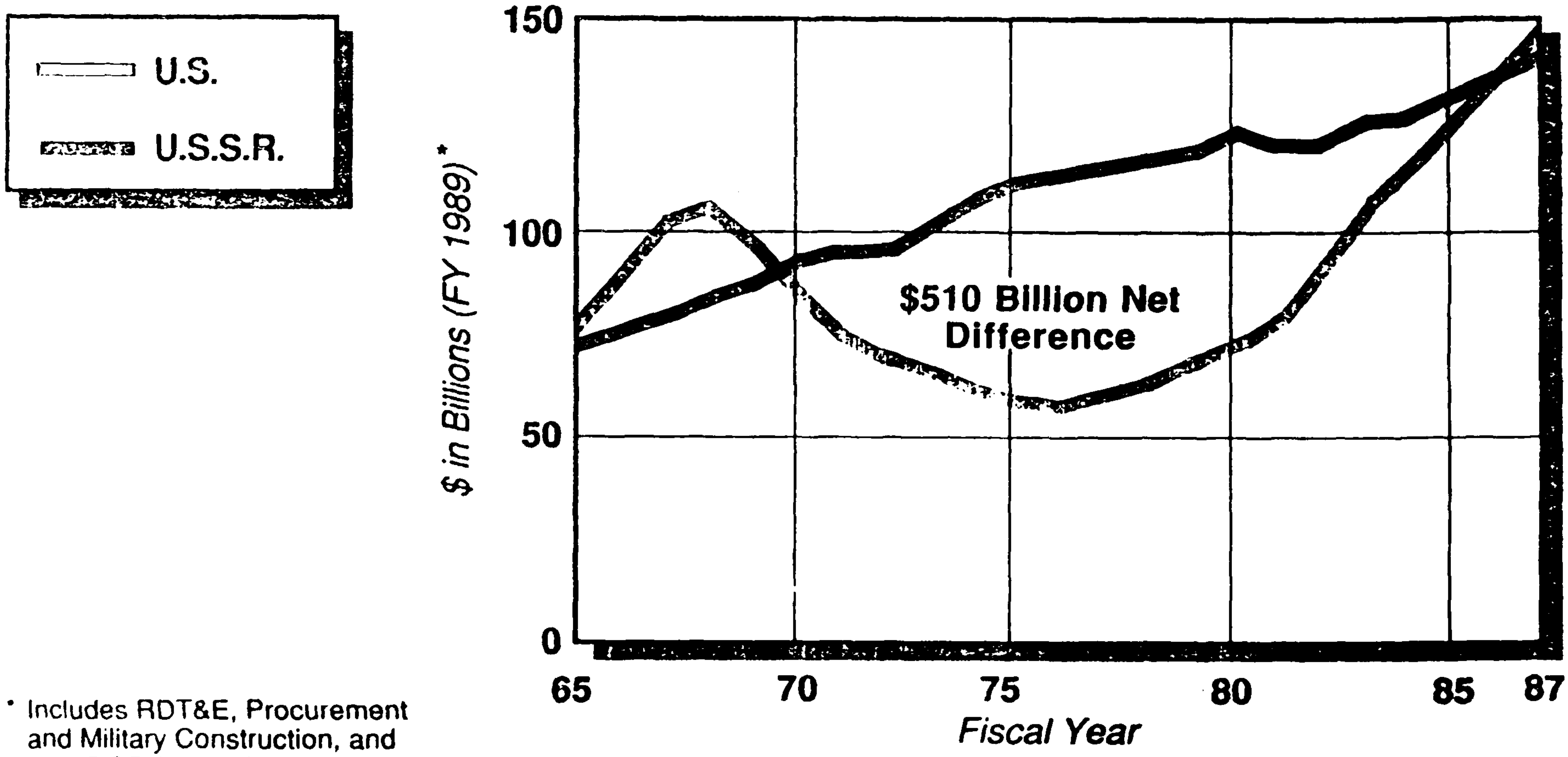


CATEGORY	1975	1980	1981	1982	1983	1984 b	1985 b.	1986 b.	1987 b.
TOA									
TOTAL	165.6	182.4	202.2	227.8	258.0	269.6	297.8	314.0	325.9
INVESTMENT	37.3	46.8	58.9	75.4	95.0	105.0	120.0	128.9	133.4
OUTLAYS[a]	163.8	174.3	181.4	195.3	215.9	233.2	255.6	276.0	288.9

[a]Reached low point of $158.0 billion in 1976.

[b]These projection will prove excessive, based on more recent Congressional action.

A Comparison of U.S. Defense Investment Expenditures With the Estimated Dollar Cost of Soviet Investment Expenditures



* Includes RDT&E, Procurement and Military Construction, and Non-DOD-Funded Programs.

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